Social housing Sterrenveld in Wezembeek BE

PROJECT SUMMARY
Sustainable renovation of a social housing tower to fullfill contemporary comfort standards

SPECIAL FEATURES
Glazed in balconies
Holistic sustainable approach

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SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

IEA – SHC Task 37
Advanced Housing Renovation with Solar & Conservation

An aerial view of the garden city Ban Eik. In the middle you see the two apartment buildings, Sterrenveld to the left and Zonneveld to the right.

The old apartment block being stripped.

BACKGROUND

This apartment block, part of the Ban Eik garden city project, was the winning design of an architectural competition in 1959. Most of the 417 residences are single family houses alongside two identical tall apartment blocks, Zonneveld and Sterrenveld, and two smaller blocks. A good mix of uses and a district heating system for the whole neighbourhood made this an examplary project in the sixties.

New construction or renovation?

After 30 years the apartment blocks were completely worn our and out of date. They were built from cheap construction materials were poorly maintained. The blocks were a problem "hotspot". When the regional social housing company “GM voor Volkshuisvesting” took over the Ban Eik, the decision was made to refurbish the whole neighbourhood. Sterrenveld and Zonneveld were slated for demolition. However, a new urban planning law forbade new construction higher than 3 levels. Considering this, the planers decided that the building structure was sound, so they opted for a thorough renovation. First Zonneveld was renovated towards the actual construction standard. In a final phase, the renovation of Sterrenveld was planned.

Stimulated by the Flemish Government through a call for pilot projects, the renovation took a holistic view of sustainability. Energy loss was minimized with insulation, heat recovery and thermal bridge alleviation. Complimenting this were solar collectors and pv panels. The social network of the neighbourhood was to be revitalized through wise use of architectural and urban planning tools.

Reflection about the programme

Ground level storage rooms were relocated to the first floor, freeing space for new residences. This improves social control on the surroundings, and links the building to its low rise neighbours.

The old co-heating boiler room, now a community centre and small office block.

The new residences on ground floor, and the storage rooms on the first floor: above on the west façade and below on the east façade.

The apartment layouts were completely redesigned. The old apartment block had one central hallway per floor without any window or ventilation. It divided the block in half, with apartments facing north or south. The new design stretched all apartments from north to south, and regrouped the inner circulation in three vertical staircases and lifts, opening to the outside.

This measure required the removal of most of the internal walls that gave the structure its rigidity. Adding balconies to the building as a new structural element, resolved this. The balconies are sheltered by a glass façade, creating "winter gardens". In summer, the glazing can be opened, converting them to normal balconies.

Extra sustainable measures

Each apartment is handycapped accessible. Two apartments per floor are adapted to the principles of lifelong living.

The old boiler room building has been converted to office space for an NGO and for the social housing company, as well as a multipurpose room for the residents. All low rise blocks have an extensive green roof.

The new winter gardens. It iss possible to open the glazing and so to have a normal balcony.

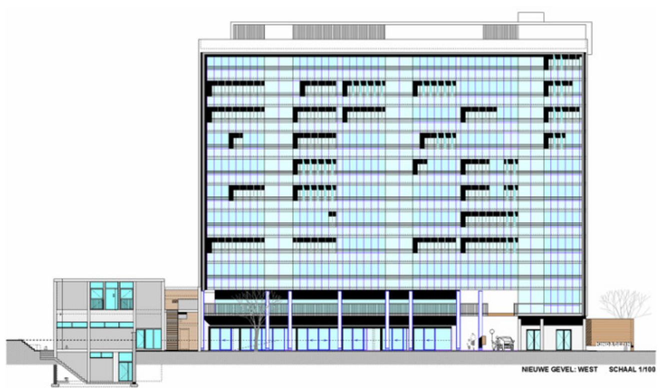
Green roof on top of the new residences. In the background you see the single family housing of the garden city.

The Sterrenveld block before the renovation. In the background you can see the already renovated Zonneveld block.

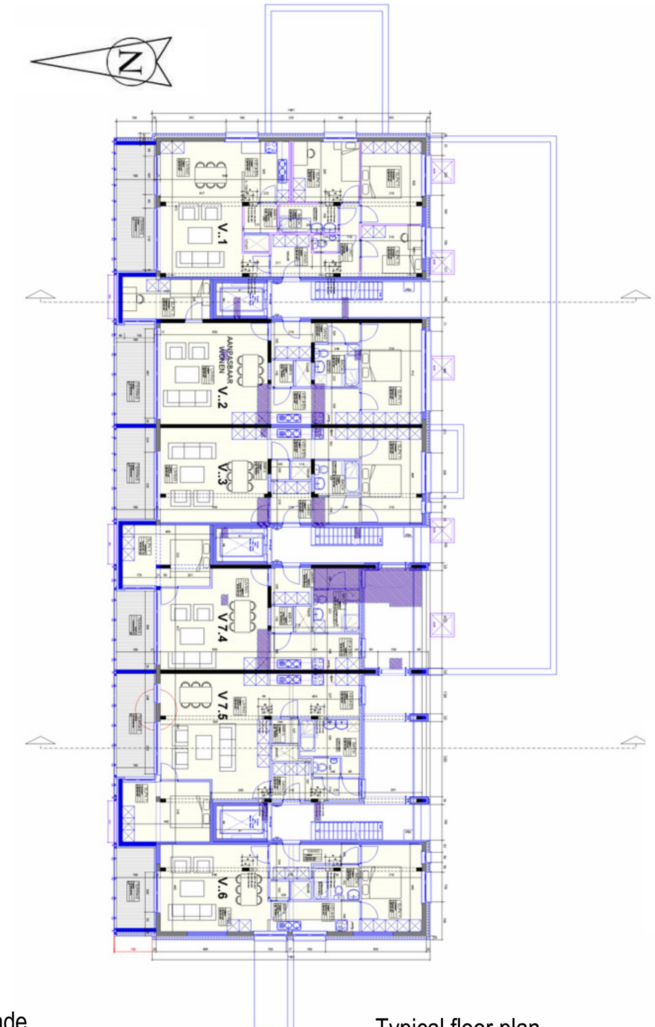
The Sterrenveld block after renovation, view on the west façade.

SUMMARY OF THE RENOVATION

- Reuse of the concrete structure
- 12 cm mineral wool insulation of the building
- Use of lightweight inner walls for flexibility
- New, ground floor, single-family residences in wooden frame construction.
- West facade was brought forward two meters, making room for large protected balconies, anchored to the existing construction (no new foundation works). The glazed in balconies reduce thermal bridges and create "winter gardens".
- Old central hallway replaced by three, decentral vertical circulation shafts, with daylighting.
- New windows with high performance double glazing (U=1.1 W/m^{2}K)



Facade



Typical floor plan

Mineral wool insulation being installed on the existing concrete walls of the north façade.

CONSTRUCTION

Roof construction — *U-value: 0,28 W/(m²·K)*

(top down)

Roofing	10 mm
Mineral wool insulation	120 mm
screed on PE foil	40 mm
Concrete slab	150 mm
Plaster	10 mm
Total	330 mm

Wall construction — *U-value: 0,41 W/(m²·K)*

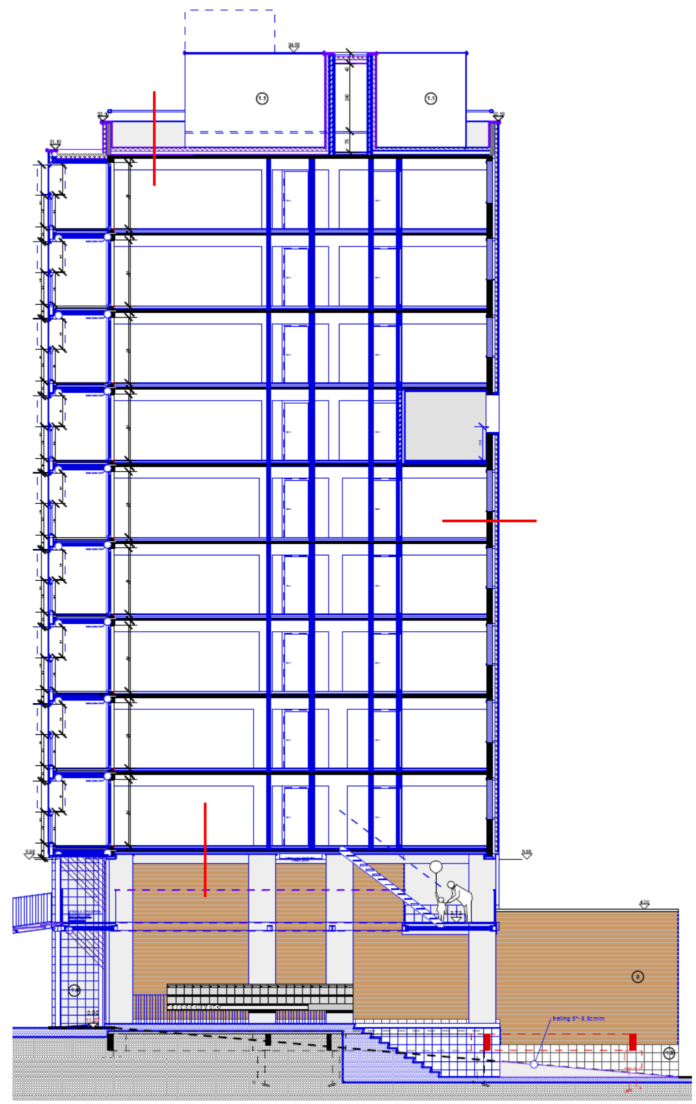
(interior to exterior)

Plaster	10 mm
Concrete	180 mm
Mineral wool insulation on PE foil	80 mm
Exterior stucco	20 mm
Total	290 mm

Ceiling above exterior — *U-value: 0,26 W/(m²·K)*

(top down)

Grès tiles	20 mm
Concrete	70 mm
Cork	10 mm
Polyurethane insulation on PE foil	30 mm
Reinforced concrete	150 mm
Mineral wool insulation	80 mm
Exterior stucco	20 mm
Total	380 mm



Thermally insulated connection between winter gardens and concrete structure.

The winter gardens on the south.

ENSURING A HIGH BUILT QUALITY

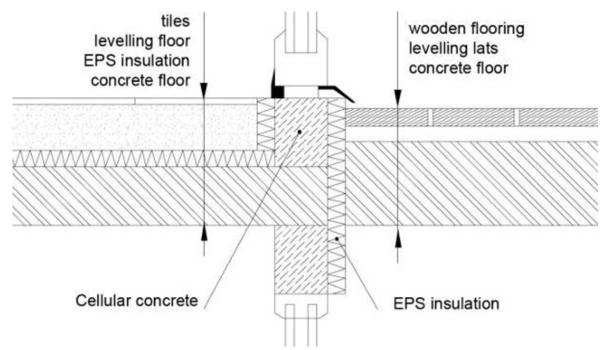
To ensure a well insulated and thermal bridge free construction, attention had to be paid to quality. The guiding principles of the project were:

- Defining goals in the technical specifications for thermal bridge free construction, air tightness, and high insulation levels.
- Carefully detailing of construction details
- Selecting contractors based on willingness and capabilities to respect sustainable principles. This had to be proven by a statement, a vision and reference projects.
- All details of importance were discussed with the contractor through execution drawings and technical files.
- Systematic on site assessment of the construction works by the building team.

A THERMAL BRIDGE FREE CONSTRUCTION

The new structure for the "winter gardens" consists of concrete slabs and steel columns. The structure gives the building its rigidity. To reduce the thermal bridging, the connection between building and "winter gardens" was reduced to a minimum. An almost continuous layer of hard insulation board runs between both concrete slabs. Chemically fixed anchors make the connection between both structures.

On the north facade, the public circulation is completely open air, and the existing floor slabs go from inside to outside. To eliminate the thermal bridging that would result, the floor slabs are completely wrapped in an insulation layer.



Connection between floor and winter garden.

The Sterrenveld building in front, the Zonneveld building In the back (right) after the renovation.

The 2 300l buffer tanks in front, and the 3 1000l buffer tanks in the back.

MONITORING

The entire technical system is monitored and controlled, in both Zonneveld and Sterrenveld. The comparison between the buildings, one standard and one low energy retrofit, leads to some interesting conclusions.

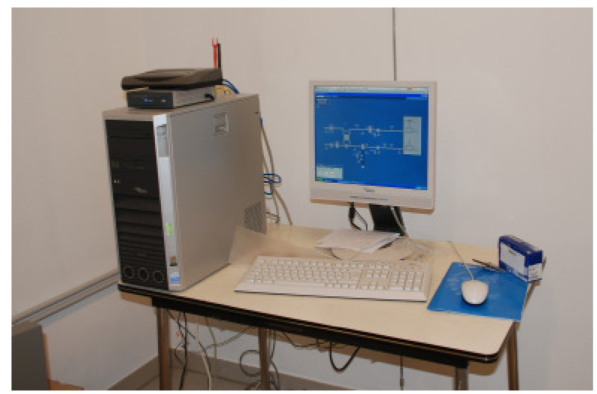
First, it underlines the importance of monitoring and fine tuning, at least for the first years after renovation. The solar thermal installation in particular needed adjustments.

Second, the benefit of the insulation measures was very evident from the measurements.

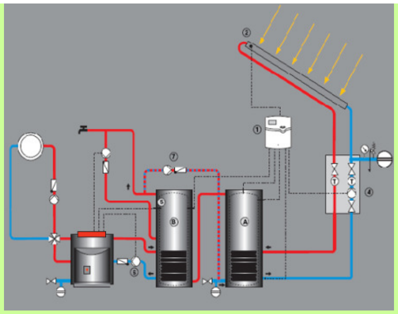
	15.10.07 – 15.10.08		15.10.08 – 29.10.08	
	Zonneveld 70 app	Sterreveld 60 app	Zonneveld 70 app	Sterreveld 60 app
Hot H_2O (l)	1.066.320	1.104.120	40.100	44.390
kWh/l Hot H_2O	0,090517	0,090099	0,093267	0,087249
% Sunboiler savings		0,46		6,45
Hot H_2O (kWh)	96.520	99.480	3.740	3.873
Heating (kWh)	248.193	255.203	9.241	6.961
Loss (kWh)	215.747	142.401	8.277	4.963
Total (kWh)	560.460	497.084	21.258	15.797
% Loss	38,5	28,6	38,9	31,4

Monitoring also allowed insights as to the influence of occupants on energy performance. In Sterrenveld, the tenants were satisfied with fairly low room temperatures. This can be explained by the larger families living in these larger apartments.

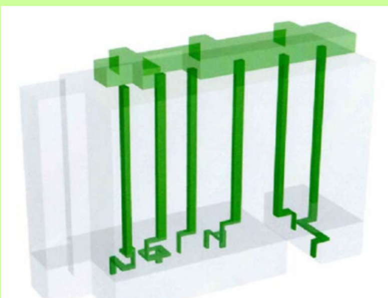
As a result, the already over dimensioned heating system could not efficiently produce the small amounts of required heat and so it kept switching on and off. While the predicted efficiency had to be around 100%, the measured efficiency was only 84% after optimisation.



The central monitoring system for the buildings Zonneveld and Sterrenveld.



Domestic Hot Water production with separate storage tanks for pre-heating (A) and post-heating (B)



6 technical shafts distribute all heating, water, electricity and ventilation.

photovoltaic solar panels and vacuum tube solar heating system on the roof of Sterrenveld.

Summary of U-values W/(m²·K)

	Before	After
Roof	0,77	0,28
Walls	2,78	0,41
Basement ceiling	6,66	0,26
Windows*	5,1	1,19

BUILDING SERVICES

- Two condensing gas boilers, one for domestic hot water (200kW) and one for low temperature heating (407kW).
- Domestic hot water production is split between pre-heating (solar thermal) and post-heating, with 3 storage tanks of 1000l each for pre-heating, and 2 storage tanks of 300l each for post-heating.
- Mechanical ventilation system with heat recovery. Due to lack of head room, the ventilation ductwork runs through six vertical shafts, connected to four heat recovery ventilation (HRV) units.
- Three types of HRV units: 1 rotary heat exchanger (R=75%), 2 cross current systems (R= 65%), 1 heat pipe. (R= 55%)

RENEWABLE ENERGY USE

- 30m² vacuum tube solar collectors, orientation south-west. Total measured production during the first 18 months: 9.9 MWh.
- 15m² polycrystalline PV panels, with a peak capacity of 19 kW. Total measured production over 17 months: 2.5 MWh.

ENERGY PERFORMANCE

Space + water heating (primary energy)*

Before: 150 kWh/m²a
After: 75 kWh/m²a
Reduction: 50%

*Flemish implementation of EPBD

INFORMATION SOURCES

VMSW, www.vmsw.be

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